DOCUMENT RESUME

ED 061 540 CG 007 083

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TITLE Effects of Anxiety on Concept Learning.
INSTITUTION Temple Univ., Philadelphia, Pa.
PUB DATE Apr 72
NOTE 13p.; Paper presented at the annual meeting of American Educational Research Association, Chicago, Illinois, April 3-7, 1972

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Anxiety; College Students; Concept Formation; *Concept Teaching; *Learning; Learning Difficulties; Learning Experience; *Performance; Task Performance
IDENTIFIERS Spielberger Trait Anxiety Inventory; State Anxiety Inventory

ABSTRACT

Sixty-one introductory psychology students were randomly assigned to two experimental treatment which consisted of either high or low ego-involving instructions. The entire experimental procedure, including the administrations of Spielberger's Trait Anxiety Inventory and State Anxiety Inventory, is elaborated. Results support the notion that state anxiety, i.e., feelings of apprehension and heightened nervous system activity, provides a more useful estimate of the relationship between anxiety and learning than trait anxiety, i.e., anxiety proneness. Support is also added to the notion that task conditions affect anxiety, in this case a concept learning task. Advantages of the author's research design are highlighted. (TL)

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Effects of Anxiety on Concept Learning

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Paper presented at the annual meeting of the American Educational Research Association, Chicago, 1972.

CG 007 083

Research investigating the relationship between anxiety and concept learning has produced inconsistent results and it has been proposed that factors such as task complexity, ego-involving conditions, and cognitive abilities might be examined in an effort to clarify these results (Denny, 1966; Meyers and Dunham, 1971). Differentiating between trait and state anxiety might also help to produce more consistent research in this area, and there is extensive evidence to support the notion that measures of anxiety which are more specific to the situation would be more likely to relate significantly to learning performance than measures of trait anxiety.

For example, I. G. Sarasson's research (Sarasson and Palola, 1960) suggests that Test Anxiety will be more likely to relate to performance of test-like tasks than trait anxiety, since test anxiety is more specific to such tasks. Similarly, Speilberger's (1966) research indicates that state anxiety (feelings of apprehension and heightened autonomic nervous system activity) is more likely to relate significantly to learning performance than trait anxiety (anxiety proneness). However, the implications of this body of research have been ignored in studies investigating the effects of anxiety on concept learning performance as general rather than situational measures of anxiety have invariably been used.

The drive theory interpretation of anxiety (Spence and Spence, 1966) has been employed to explain the relationships between anxiety and concept learning performance (Maltzman, Fox and Morrissett, 1953; Denny, 1966). According to this position, the learning performance of high anxious Ss will be inferior to that of low anxious Ss on tasks with competing responses (i.e., incorrect

response tendancies which are higher in the habit hierarchy than correct response tendancies). On tasks low in competing responses (i.e., where the correct response is dominant relative to incorrect responses) it is predicted that performance of high anxious Ss will be superior to that of low anxious Ss. Since extra-dimensional shift concept learning tasks involve an unannounced shift in the solution of the task, the responses which are originally learned are incorrect in the final portion of the task, and the incorrect response tendancies are higher in the habit hierarchy than the correct responses. While this would be a good task with which to assess the effects of anxiety (drive) on learning, these effects have not previously been investigated with this task.

Whereas much of the important work investigating the relationship between anxiety and learning has been oriented to determining the effects of anxiety on learning performance, recent investigations have also begun to determine the effects of the task on the state anxiety experienced by Ss. For example, Martin (1970) reported that qualifying examinations for doctoral candidates created substantial levels of state anxiety and that the degree of anxiety increased as the date of the exam approached. In addition, Martin and Meyers (1972) have shown that the level of state anxiety increased as the date of a final examination became more proximate. Finally, O'Neill, Spielberger and Hansen (1969) found that the level of difficulty of a task had a significant effect on the state anxiety experienced by Ss. As expected, anxiety was relatively high on a difficult task when compared with an easier task, and anxiety was relatively high when measured early rather than late in performance.

It was the purpose of this investigation to examine the nature of the relationships between anxiety and concept learning in terms

of drive theory. The focus was to determine whether state anxiety would have a stronger effect on concept learning performance than trait anxiety, and to determine whether the experimental situation (high or low ego-involving instructions and the task) would have a significant effect on the level of state anxiety experienced by Ss.

Method

Subjects

The Ss were 61 introductory educational psychology students at the University of Texas at Austin. Ss were randomly assigned to two experimental treatments which consisted of either high or low ego-involving instructions (adapted from Sarasson, 1956). There were 32 Ss in the high involvement condition and 29 Ss in the low involvement condition.

Procedure

All of the data were collected during individual testing sessions (i.e., one session per S). Immediately prior to the experimental conditions, Ss filled out a short form (O'Neill, Spielberger and Hansen, 1969) of the Spielberger Trait Anxiety Inventory (Spielberger, Gorsuch and Lushene, 1970). The short form of the Spielberger State Anxiety Inventory was used so that state anxiety could be assessed five times, producing minimal interference with performance. Either high or low ego-involvement instructions were administered as part of the task instructions upon completion of the trait anxiety inventory. The second measure of state anxiety (state #2) was administered immediately following the involving instructions.

The concept learning task consisted of two consecutive unidimensional, four-category concept problems. The second problem served as a transfer problem and was begun immediately after a criterion of 13 consecutive correct responses was reached on the first problem. The transfer condition was an extra-dimensional shift on which the dimensions and values of the transfer problem were the same as the dimensions and values of the original learning problem.

State anxiety was assessed at three additional points during the task producing a total of five state measures: 1) early during the original learning problem (state #3); 2) early during the transfer problem (state #4); 3) late in the performance of the transfer problem (state #5).

Results

Effects of Anxiety on Performance

Two by two analyses of variance were computed to determine the effects of anxiety on concept learning. The four groups were defined by all combinations of ego-involvement (high and low) and anxiety (high and low;median splits), and this analysis was computed five times (once for trait anxiety, and once for each of the first four measures of state anxiety). There were four dependent measures: 1) number of errors early (trials 5-19) during the original learning problem; 2) total number of errors on the original learning problem; 3) number of errors early (tiials 3-17) during the transfer problem; and 4) total number of errors on the transfer problem.

It was expected that trait anxiety would not have as strong an effect on learning performance as state anxiety, and this prediction is supported by the present data. Trait anxiety had no significant relationships to performance, whereas the first measure or state anxiety did have significant relationships to performance.

State #1, which was administered prior to all experimental procedures, had a significant effect early in the original learning problem ($\underline{F}$ = 4.52; $\underline{p}$ <.04), and on the total number of errors for the original learning problem ($\underline{F}$ = 7.61; $\underline{p}$ <.01). On the transfer problem this measure of state anxiety had a significant effect on the number of errors early in the task ($\underline{F}$ = 5.46; $\underline{p}$ <.03), however, this significant effect was not maintained for the total number of errors on the transfer problem ($\underline{F}$ = 2.18; $\underline{p}$ <.15). The means from these analyses are reported in Table I and all of the results are in the predicted direction. In other words, the performance of high anxious $\underline{S}$s (state #1) was consistently inferior to that of low anxious $\underline{S}$s and thus the Spence interpretation of anxity as a drive received some support. On the other hand, there were no significant effects for the remaining three measures of state anxiety (those administered immediately after the ego-involving instructions, early during original learning, and early during the transfer problem). The means for these results are reported in Table II.

Factors Affecting State Anxiety

The fifth measure of state anxiety, which was administered near completion of the transfer task also had a significant relationship to performance. However, since this measure was taken when the task was almost finished it was assumed that performance

of the task had an effect on the level of anxiety rather than the reverse. Consequently, a Pearson Product Moment Correlation was used to determine the relationship between performance and anxiety. As anticipated there was a moderate relationship ($r = .35$) such that poor performance was associated with high anxiety. However, it was found that this relationship was dependent on the ego-involving instructions. While there was a rather high relationship ($r = .49$) for Ss in the high ego-involving condition, there was essentially no relationship between performance and anxiety for Ss in the low ego-involving condition.

In order to further define the effectes of the experimental situation on state anxiety, a repeated measures analysis of variance was computed in which two experimental groups were determined by the high and low ego-involving instructions. Scores from the state anxiety questionnaires were used as the dependent measures, and the five different administrations of the scale comprised the repeated measures for the analysis. There was a significant main effect for trials on the state measure, ($F = 5.04$; $p < .001$), and a significant interaction between ego-involvement and trials, ($F = 3.76$; $p < .01$). The means reported in Table III reveal that there are no differences in scores on the five state anxiety measures for Ss with low ego-involvement, whereas the anxiety scores did vary significantly for Ss with high ego-involving instructions. The prediction that the experimental situation would affect the level of state anxiety was confirmed as the high ego-involving instructions produced a significant increase in the level of state anxiety. This level of anxiety subsequently decreased near the completion of the task.

DISCUSSION

One goal of the present study was to determine whether state anxiety would produce a stronger relationship to performance of a condept learning task than trait anxiety. This expectation was confirmed. These results support Spielberger's State-Trait interpretation of anxiety in that a measure of state anxiety was significantly related to performance of a concept learning task while a measure of trait anxiety revealed no such relationship.

The measures of state anxiety taken subsequent to the ego-involving instructions did not relate significantly to learning performance. Although these results appear to be inconsistent with Spielberger's theory, there are some potential explanations. First, the use of a four item scale and its repeated administration are two issues which may have obscured the results. Second, Table II reveals that as predicted the performance of Ss with high state anxiety, is consistently inferior to that of Ss with low state anxiety, particularly for the original learning trials. Conversely, Table II reveals that there were no observed mean differences between Ss with high and low trait anxiety. A general conclusion from this data is that the more specific measures of anxiety such as state anxiety are most likely to reveal significant relationships to learning performance. In addition, it can be concluded that state anxiety is likely to have a debilitating effect on four-category unidimensional concept learning tasks. Thus, even the non-significant results provide some qualified support to both the Spence and Spielberger interpretations of anxiety.

As noted above, these results were in the predicted direction such that the performance of high anxious Ss was inferior to that of low anxious Ss, and thus the Spence interpretation of anxiety as a drive received confirmation. It was hypothesized that the unannounced shift in solution of the task would create relatively high numbers of competing responses. Therefore, the significant debilitating effect of anxiety on performance immediately after the shift is interpreted as supportive of drive theory. A unique aspect of the design of this investigation is that performance was assessed at several different points. If the performance measure most specifically associated with competing responses (i.e., early in the transfer problem) had not been used, the data most supportive of drive theory would not have been noticed.

It is clear from the results of this investigation that the experimental conditions had a significant effect on the level of state anxiety. First, it appears that neither the task nor the instructions had a significant impact on the level of state anxiety when low ego-involving instructions were used. On the other hand, the high ego-involving instructions produced a significant increase in the level of anxiety whereas performance of the task did not have this effect. Approaching successful completion of the task did produce a decrease in the level of anxiety for these Ss. This confirms prior results where (O'Neill, Spielberger and Hansen, 1969) state anxiety was lowest during the latter portion of a learning task.

An interesting aspect of these findings is that the effects of the experimental conditions on state anxiety which were obtained under relatively threatening conditions were eliminated when less threatening conditions were employed. An implication of this finding

is that there is potential to control the anxiety provoking aspects of test like situations by altering the instructions.

SUMMARY

The present study is important because it supports Spielberger's theoretical notion that state anxiety provides a more useful estimate of the relationship between anxiety and learning than trait anxiety. Moreover, it is the first study to demonstrate that this assumption applies with a concept learning task. The results of this study add support to the notion that task conditions affect anxiety, and it is demonstrated that in the present experimental conditions it was possible to control the situation in order to reduce its effects on anxiety. Also, the debilitating effects of state anxiety on performance of the present task provides strong support for the Spence interpretation of anxiety as a drive. Finally, it was demonstrated that assessing anxiety at different points in time and measuring anxiety during performance of the task is an important contribution to research designs attempting to study the effects of anxiety on learning.

Table 1

Mean Number of Errors on Each Dependent Measure
Representing Main Effects for Each of Five Anxiety Variables

Dependent Measures	ANXIETY									
	Trait		State #1		State #2		State #3		State #4	
	High	Low	High	Low	High	Low	High	Low	High	Low
Original Learning Early	6.4	6.0	7.3	5.0*	6.9	5.4	6.7	5.8	6.5	5.8
Original Learning Late	14.5	15.2	19.5	9.8**	17.3	12.1	18.6	12.0	16.5	12.6
Transfer Learning Early	8.0	8.3	9.1	7.2*	8.4	8.0	8.8	7.7	8.4	7.9
Transfer Learning Late	25.6	21.2	27.5	19.0	25.5	21.3	28.1	19.7	26.7	19.3

* $p < .05$
** $p < .01$

Table 2

Group Means for State Anxiety

Involvement Conditions	State 1	State 2	State 3	State 4	State 5
High Involvement	7.8	9.7	9.7	9.5	8.8
Low Involvement	8.8	8.8	8.8	8.9	8.7

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